Center Innovation Fund: JSC CIF

Ionic Monopropellant Compatibility Study

Completed Technology Project (2011 - 2013)

Project Introduction

High performance green monopropellants require means of detection and remediation of spills and residues. This project investigated color tests for spill detection and methods for remediation. Innovation was achieved using COTS test kits, and both fundamental and novel chemistry applied to the monopropellant ingredients. The second phase examined candidate materials for use in AF-M315E propulsion systems. Pairs of representative alloys, passivated and native, were immersed in AF-M315E at 71 °C for 31 d, fluid samples were periodically characterized and post-test materials and fluids were finally characterized. Typical corrosion studies use only the total time of immersion; this study also obtained interim data points. The image shows a surface treated alloy on the left and the untreated alloy on the right.

Candidate hydrazine alternatives have been developed for spacecraft propulsion. The U.S. Air Force AF-M315E and the Swedish ammonium dinitramide propellants have received the most attention, while ammonium dinitramide propellants are a possible contender. While greenness relates to environmentally benign and relative toxicity, neither of these propellants is completely "nontoxic" or completely safe; if their energetic nature was not inherent they would not be used as monopropellants. This is particularly important with ammonium dinitramide (ADN) and hydrazinum nitroformate (HNF) propellants, which ESA and the EU has favored while the U.S. Air Force has focused on AF-M315E and the U.S. Army has investigated hydroxylammonium nitrate/triethanolammonium nitrate (HAN/TEAN; XM-46) propellants. The first phase of the project's focus will be to evaluate detection and decontamination methods for these propellants. The second phase examined candidate materials for use in AF-M315E propulsion systems. Pairs of representative alloys, passivated and native, were immersed in AF-M315E at 71 °C for 31 d, fluid samples were periodically characterized and post-test materials and fluids were finally characterized. Typical corrosion studies use only the total time of immersion; this study also obtained interim data points.

Anticipated Benefits

AF-M315E is the propellant in NASA’s Green Propellant Infusion Mission (GPIM)

Project Image Ionic Monopropellant Compatibility Study

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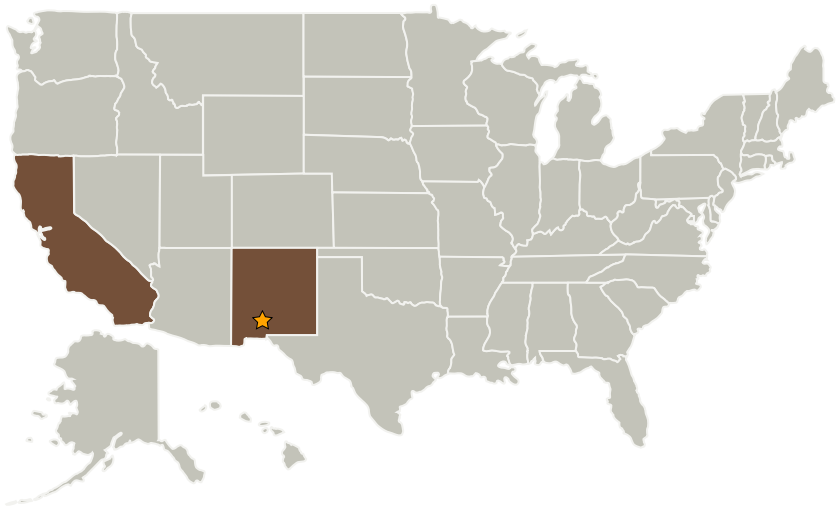
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★White Sands Test Facility(WSTF)	Lead Organization	NASA Facility	Las Cruces, New Mexico
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas

Co-Funding Partners	Type	Location
Air Force Research Laboratory(AFRL)	US Government	Notre Dame, Indiana

Primary U.S. Work Locations	
California	New Mexico

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

White Sands Test Facility (WSTF)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Mark B Mcclure

Principal Investigator:

Mark B Mcclure

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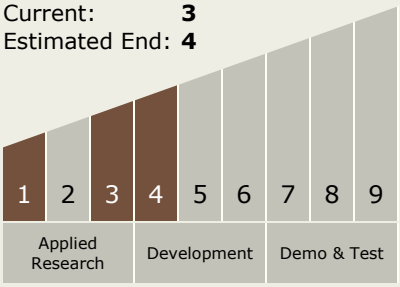
Images

12072-1376483017355.jpg
Project Image Ionic Monopropellant Compatibility Study
(https://techport.nasa.gov/image/2212)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.2 Earth Storable